Listing of the Claims

1. (Original) A magnetic resonance imaging method wherein

- magnetic resonance signals are acquired by means of a receiver antennae system via a plurality of signal channels
  - which receiver antennae system has a sensitivity profile
  - the magnetic resonance signals are acquired with undersampling
  - for respective orientated sector shaped regions in k-space, regularly re-sampled magnetic resonance signals are re-sampled on a regular sampling grid from the undersampled acquired magnetic resonance signals
  - the re-sampling involving convolution of the undersampled acquired magnetic resonance signals by a gridding kernel
    - the gridding kernel depending on
    - the orientation of the sector shaped region at issue and
    - the sensitivity profile of the receiver antennae system and
  - a magnetic resonance image is reconstructed from the re-sampled magnetic resonance signals.

2. (Original) A magnetic resonance imaging method as claimed in Claim 1, wherein the magnetic resonance signals are acquired by scanning k-space along a non-linear, in particular spiral shaped, trajectory.

3. (Original) A magnetic resonance imaging method as claimed in Claim 1 for forming an image of an object wherein

- a magnetic resonance image is derived from sub-sampled magnetic resonance signals and on the basis of the spatial sensitivity profiles of a plurality of receiving antennae,
- a sequence of RF-pulses and gradients is applied, which sequence corresponds to a set of trajectories comprising at least one substantially non-linear trajectory in k-space, wherein the sampling density of said trajectory set being substantially lower than the normal sampling density corresponding to the object size,

- each signal along said trajectory set is sampled at least at two different receiver antenna positions, resulting into a plurality of receiver-antenna signals,
- the image is reconstructed by converting the data of said signals from said trajectory set to a Cartesian grid by convolution with a gridding kernel,

and whereby

- the gridding kernel is a Fourier-transform of a pattern weighted for each antenna with respect to the Cartesian grid, and
- the gridding kernel pattern differs between one region and another in k-space.

4. (Original) A method as claimed in claim 1, wherein the weighting pattern is obtained in that

- to every individual region of k-space, a set of parallel equidistant lines is assigned, which lines locally match said trajectory set,
- a pattern of overlapping points in image space is determined, which corresponds to the set of parallel equidistant lines in k-space,
- in image space, the weighting pattern per antenna is calculated, which pattern approximately corresponds to a pattern solely of said parallel equidistant lines in the individual region of k-space.

5. (Original) A method as claimed in claim 2, wherein at least part of the trajectory set corresponds to an Archimedic spiral and the regions in k-space are defined by their azimuthal angle in k-space.

6. (Currently Amended) A method as claimed in claim ~~4 or 5~~, wherein the weighting pattern of the antenna is calculated according to the inversion of a Cartesian set of equations for the subsampled data and the spatial sensitivity profiles of the receiving antennae.

7. (Original) A method as claimed in claim 6, wherein the inversion of said Cartesian set of equations is formulated as $A = (S^h \cdot \Psi^{-1} \cdot S + R^{-1})^{-1} \cdot S^h \cdot \Psi^{-1}$, wherein A is the reconstruction matrix, S is the receiver antenna sensitivity matrix (s_{ij}), wherein s_{ij} is the spatial sensitivity profile of antenna i on the j-th point of the overlapping set of points, Ψ is the noise covariance between the antennae, R is the regularization matrix and S^h means the hermitian conjugate of S.

8. (Original) A method as claimed in claim 7, wherein the gridding kernel is chosen to correspond to a larger FOV as the normal FOV covering the size of the object to be studied and the values of the regularization matrix R between the margin of the larger FOV and the normal FOV are set to zero.

9. (Original) A method as claimed in claim 8, wherein the gridding kernel pattern for each antenna derived from the reconstruction matrix A is multiplied with a common shaping function comprising a tapering window function or the sum of squares of sensitivities of each antenna.

10. (Currently Amended) A method as claimed in claim 5~~-to-9~~, wherein the gridding kernel functions between the two nearest radii traversing the spiral trajectory set are interpolated.

11. (Original) A method as claimed in claim 10, wherein both radii are gridded and the result thereof is interpolated.

12. (Currently Amended) A method as claimed in one of claims 1~~-to-11~~, wherein the most central region of k-space is reconstructed at full sampling density by direct inversion and the result of the gridding reconstruction method is blended with the result of the reconstruction at full sampling density.

13. (Currently Amended) A method as claimed in ~~one of~~ claims 7~~-to-12~~, wherein the gridding kernel pattern for each antenna derived from the reconstruction matrix A is divided into a defined number of subfunctions, for which the support of the corresponding functions in k-space tends to zero, in order to discard sharp transitions in the gridding kernel pattern, whereas each subfunction is gridded separately.

14. (Original) A method as claimed in claim 10, wherein sets of samples assigned to adjacent radii are gridded and transformed separately.

15. (Currently Amended) Use of the image generated by the method as claimed in ~~one of~~ claims 1~~-to-14~~, in order to initialize a conventional iterative algorithm for reconstruction of the image.

16. (Original) A magnetic resonance imaging apparatus for obtaining an MR image from a plurality of signals comprising:

- a main magnet,
- a transmitter antenna for excitation of spins in a predetermined area of the patient,
- a plurality of receiver antennae for sampling signals in a restricted homogeneity region of the main magnet field,
- a table for bearing a patient,
- means for continuously moving the table through the bore of the main magnet,
- means for deriving a magnetic resonance image from sub-sampled magnetic resonance signals and on the basis of the spatial sensitivity profile of each of said receiving antenna positions,
- means for applying a sequence of RF-pulses and gradients, which sequence corresponds to a set of trajectories comprising at least one substantially non-linear trajectory in k-space, wherein the density of said trajectory set being substantially lower than the density corresponding to the object size,
- means for sampling each signal along said trajectory set at least at two different receiver antenna positions, resulting into a plurality of receiver-antenna signals,
- means for reconstructing the image by converting the data of said signals from said trajectory set to a Cartesian grid by convolution with a gridding kernel,

and whereby

- the gridding kernel is specific for each antenna,
- the gridding kernel pattern differs between one region and another in k-space, and
- the gridding kernel is a Fourier-transform of a pattern weighted for each antenna with respect to the Cartesian grid.

17. (Original) Apparatus according to claim 16, further comprising

- means for obtaining the weighting pattern including
- means for assigning, to every individual region of k-space, a set of parallel equidistant lines, which lines locally match said trajectory set,
- means for determining a pattern of overlapping points in image space, which corresponds to the set of parallel equidistant lines in k-space, and
- means for calculating, in image space, the weighting pattern per antenna, which pattern approximately corresponds to a pattern solely of said parallel equidistant lines in the individual region of k-space.

18. (Original) Apparatus as claimed in claim 17, further comprising means for defining the regions in k-space by their azimuthal angle in k-space, whereas at least part of the trajectory set corresponds to equidistant spirals.

19. (Currently Amended) Apparatus method as claimed in claim 17~~ or 18~~, further comprising means for calculating the weighting pattern of the antenna according to the inversion of a Cartesian set of equations for the subsampled data and the spatial sensitivity profiles of the receiving antennae.

20. (Original) Apparatus as claimed in claim 19, whereas said means for calculating the inversion of said Cartesian set of equations is based on formula $A = (S^h \cdot \Psi^{-1} \cdot S + R^{-1})^{-1} \cdot S^h \cdot \Psi^{-1}$, wherein A is the reconstruction matrix, S is the receiver antenna sensitivity matrix (s_{ij}), wherein s_{ij} is the spatial sensitivity profile of antenna i on the j-th point of the overlapping set of points, Ψ is the noise covariance between the antennae, R is the regularization matrix and S^h means the hermitian conjugate of S.

21. (Original) A computer program product stored on a computer usable medium for forming an image by means of the magnetic resonance method, comprising a computer readable program means for causing the computer to control the execution:

- creating a main magnetic field by a main magnet,
- excitation of spins in a predetermined area of the patient by a transmitter antenna,
- sampling a plurality of signals in a restricted homogeneity region of the main magnet field at a plurality of receiver antenna positions,
- continuously moving a table bearing a patient through the bore of the main magnet,
- deriving a magnetic resonance image from sub-sampled magnetic resonance signals and on the basis of the spatial sensitivity profile of each of said receiving antenna positions,
- applying a sequence of RF-pulses and gradients, which sequence corresponds to a set of trajectories containing at least one substantially non-linear trajectory in k-space, wherein the density of said trajectory set being substantially lower than the density corresponding to the object size,
- sampling each signal along said trajectory set at least at two different receiver antenna positions, resulting into a plurality of receiver-antenna signals,
- reconstructing the image by converting the data of said signals from said trajectory set to a Cartesian grid by convolution with a gridding kernel,

and whereby

- the gridding kernel is specific for each antenna,
- the gridding kernel pattern differs between one region and another in k-space, and

the gridding kernel is a Fourier-transform of a pattern weighted for each antenna with respect to the Cartesian grid.